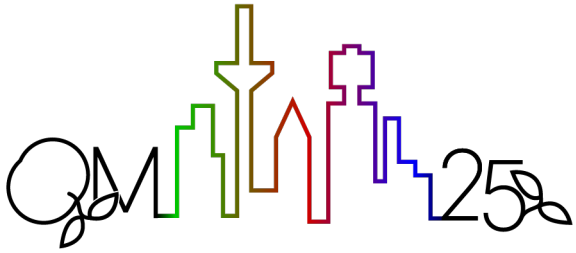

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Probing Dense Nuclear Matter with Strangeness and Hypernuclei at the CBM Experiment

The CBM experiment at FAIR aims to study the properties of dense nuclear matter at the edge of the quark-gluon plasma phase transition. This extreme environment offers a unique opportunity to study hyperon-nucleon and hyperon-hyperon interactions through the production and decay of multi-strange particles and hypernuclei. Understanding these interactions is critical for describing the nuclear equation of state at high densities and the structure of neutron stars.

CBM's exceptional capabilities, including the world's highest interaction rate coupled with high-precision tracking and particle identification, enable comprehensive measurements of rare multi-strange particles and double-lambda hypernuclei. This extends to two- and three-body decays with neutral daughters, significantly expanding the accessible decay channels and providing stringent constraints on theoretical models.

The KFParticle Finder package will be employed to identify the complex topologies of multi-strange particle and double-lambda hypernuclei decays, enabling precise measurements and analysis.

Results of multi-strange particles like Ξ and Ω reconstruction in the Au+Au collision at FAIR energies will be presented. The possibility of discovering rare double-lambda hypernuclei like ${}^{4}_{\Lambda\Lambda}\mathrm{H}$, ${}^{4}_{\Lambda\Lambda}\mathrm{n}$ and ${}^{6}_{\Lambda\Lambda}\mathrm{He}$ also will be discussed.

Extensive feasibility studies demonstrate CBM's ability to measure these rare probes with high precision and statistics. The sophisticated analysis of this data will shed light on hyperon-hyperon interactions, paving the way for a comprehensive investigation of hypernuclei at FAIR. These measurements will provide crucial insights into the properties of dense nuclear matter under extreme conditions.

Category

Experiment

Collaboration (if applicable)

CBM

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